

# APPLIED MATHEMATICS

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## MODELING AND ANALYSIS OF CELLULAR CDMA FORWARD CHANNEL

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In this thesis, the forward channel model for a DS-CDMA cellular system operating in a slow-flat Rayleigh fading and lognormal shadowing environment is developed, which incorporates the extended Hata model to predict median path loss. Forward error correction is integrated into the model by applying convolution encoding with soft-decision decoding. The worst-case probability of bit error for a mobile user at the edge of the center cell of a seven-cell cluster is developed using Gaussian approximation. In estimating the probability of bit error, a statistical model is developed which approximates the sum of  $d$  multiplicative chi-square (two degrees of freedom)-lognormal random variables as a multiplicative chi-square (with  $2d$  degrees of freedom)-lognormal random variable. Using this approximation, the performance of the cellular system is examined under a range of shadowing conditions, for various user capacities and with antenna sectoring as they compare with Monte Carlo simulated results. Next, our worst-case performance analysis is modified to accommodate users that are distributed in the cell according to a specified distribution and compare results with the worst-case performance. Finally, a fast power control is introduced into the forward channel and explore system performance with power control under a range of operating conditions as it compares with the fixed-power performance.

**DoD KEY TECHNOLOGY AREAS:** Command, Control, and Communications, Modeling and Simulation

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